INTERNATIONAL JOURNAL FOR NUMERICAL AND ANALYTICAL METHODS IN GEOMECHANICS
Int. J. Numer. Anal. Meth. Geomech., **23**, 1171–1172 (1999)

BOOK REVIEWS

TIME EFFECTS IN ROCK MECHANICS, Series in Materials, Modeling and Computation, N. D. Cristescu, U. Hunsche, Wiley, Chichester, U.K., 1998, 342 pages, ISBN 0 471 95517 5

Rock Mechanics shares with other companion disciplines of the broad field of Theoretical and Applied Mechanics the objective to model the behaviour of the natural materials (consisting in the specific case of rock masses, of their weathered portions and of the fractures and joints formed during their genesis or during their evolution) through rational methods based on the mathematical interpretation of the observed phenomena.

In addition to that, however, it attempts to combine theoretical developments, experimental observations, numerical/analytical methods, and also the experience gained in the field during construction/excavation works, in an integrated knowledge applicable to the solution of actual engineering problems. Taking this into account, a clear limit cannot be established between 'basic' Rock Mechanics and its applications, which are customarily referred to as Rock Engineering.

With this respect, the book prepared by Nicolae Cristescu and Udo Hunsche represents a remarkable contribution to the field of Rock Engineering.

Those who are involved by their professional or academic activity in the variety of problems amenable to this field are well aware that time frequently has an important role in defining the behaviour of natural rock masses. In spite of this, it can be observed that while linear elastic and elasto-plastic analyses are customarily adopted in Rock Engineering practice, for the design of major works such as tunnels and underground openings, the use of time dependent or 'creep' laws is relatively less common.

This is apparently due to two main causes. The first one depends on the complex theoretical aspects involved by many creep laws, which in turn lead to mathematical models which are often appreciably more cumbersome than those adopted for time independent calculations. A second problem concerns the difficulties encountered in the experimental investigation required for defining the relevant parameters of these laws.

This book represents a successful attempt to reduce the gap existing between the theoretical and the experimental studies of the time-dependent behaviour of rocks and their applications in engineering practice.

The work can be subdivided into three main parts which deal, respectively, with the experimental investigation, with the derivation of proper creep laws and with the applications to engineering problems.

The experimental aspects are presented in the first three Chapters of the book, which are particularly related to laboratory testing. They illustrate the main characteristics of a variety of experimental devices and testing procedures, ranging from the relatively simple uniaxial compression test, to the sophisticated 'true triaxial' apparatus. The main characteristics of the observed behaviour are illustrated through the discussion of typical experimental diagrams. This permits to single out the phenomena which characterize the behaviour of rocks (such as reversible and non-reversible deformation, dilatancy/compressibility transition, primary, secondary and tertiary 'phases' of creep, etc.) and to elucidate the main concepts which are at the basis of the developments discussed in the subsequent chapters. The influence of external causes on the observed creep behaviour is also discussed, considered in particular the effects of temperature and water.

This initial part of the book provides the readers, even those having a limited knowledge in this specific field, with the necessary background for appreciating the details of the mathematical derivation of the creep constitutive models discussed in Chapters 4–6.

This complex problem is approached by considering the general characteristics of proper creep laws and illustrating the criteria that permit to choose between alternative models, on the basis of the experimental evidence. Then the details of these models are discussed that permit to account for steady state and transient time-dependent deformation, failure induced by creep, 'damage' effects, inherent and induced anisotropy, etc.

The last part of the book (Chapters 7–10) concerns the applications to various problems of interest in Civil, Mining and Petroleum Engineering. They are related to the determination of the *in situ* stress state in rock masses, to the deformation and possible failure of tunnels and deep boreholes, to the stability of rock chambers.

The matter condensed in this book covers a wide range of experimental, theoretical and practical problems in a straightforward, 'didactic' manner. This makes it particularly suitable for use as a text book for graduate students. In addition, it has a sound engineering basis and contains a number of practical hints that suggest it as a valuable support for designers and consultants operating in the field of Rock Engineering.

G. Gioda
Technical University (Politecnicó) of Milan
Milan, Italy

VIBRATION ANALYSIS AND FOUNDATION DYNAMICS, N. S. V. Kameswara Rao, New Delhi, 1998, ISBN 81 7544 001 5

The book 'Vibration Analysis and Foundation Dynamics' by Professor N. S. V. Kameswara Rao is a welcome addition to the field of geotechnical engineering in general and to the subject of Soil and Foundation Dynamics in particular. Most of the books available presently are primarily Geotechnical Engineering-based while the above one presents the subject matter from the perspective of Engineering and Continuum Mechanics while at the same time covering numerical analysis, the design and the construction aspects. Professor Kameswara Rao is an acknowledged expert on the subject and brings out in this book the vast experience he has gained while teaching and practising the field over the last 30-odd years.

As the title aptly conveys, the first-half of the book discusses the analysis of vibrations. After a brief introduction, the basic concepts of dynamic systems have been dealt with in detail in Chapter 2. Free and forced vibration analyses of single- and multi-degrees-of-freedom systems without and with viscous, Coulombic and hysteretic damping are covered in Chapters 3 and 4. Numerical solutions of free and forced vibration problems are covered in the next two chapters (Chapters 5 and 6). The topic of vibrations of continuous media with emphasis on one, two- and three-dimensional problems follows in Chapter 7.

In the second-half of the book, the basic principles developed in the earlier chapters are applied to foundations subjected to dynamic loads (Chapter 8). Analysis of both block and pile foundations has been discussed in detail. The topics of physical modelling, discrete and continuum analysis, and methods of analysis with detailed notes on determining the relevant parameters are extensively covered in the above chapter. The application of the powerful tool of the Finite Element Method to solve foundation dynamics problems is illustrated in Chapter 9. Chapter 10 covers the subject matter relating to framed foundations and structures.

The next three chapters are concerned with some practical aspects of foundation dynamics, viz., vibration isolation and control in Chapter 11, tests to determine the design parameters in Chapter 12 and the design and construction aspects in Chapter 13. The last chapter appropriately covers some of the advanced topics, notably the recently developed subject of wavelets.

The book is lucid and well written, the text running through 650 pages with nearly 290 figures facilitating the reader to easily follow and digest the material being presented. The book is particularly useful as a text book for the course on Foundation Dynamics at a postgraduate level as well as on Vibration Analysis at the undergraduate level. For the student, the problems given at the end of relevant chapters are very useful. The references listed at the end of each chapter are convenient, as the reader can locate them easily for further reading. Practising engineers and designers can have the best of both worlds in that the basics and the principles of design and construction of machine foundations are covered between one set of covers.

M. R. Madhav
Department of Civil Engineering
IIT – Kanpur, India